MICROARRAY-BASED NEUROINTERFACES

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Over the last few years, the importance of cell and tissue culture methodologies is steadily increasing in both fundamental and applied R&D. Thus for example the microelectrode array (MEA)-based neurointerfaces allowing long-term recording of both spontaneous and evoked activities of large neuronal populations have become an invaluable research tools in fundamental neurosciences and begin to be extensively used in cytotoxicity and other drug screening assays.
Using silicon microtechnology and micromachining, our group is designing and realizing cellular interfaces with arrays of either metallic or ion-selective microelectrodes (ISEs).The former, comprising between 60 and 4096 planar Pt or Au microelectrodes of typically 5 μm to 30 μm in diameter, is aimed at the long-term recording of the electrophysiological activities of cardiomyocyte and neuronal cell cultures [1,2]. Realization of conventional thin-film Pt-MEAs integrated with clustering structures and CMOS-based high-density arrays and their functional characteristics for electrophysiological recordings of neuronal and cardiomyocyte cell cultures will be discussed.
The latter is an array of 16 silicon nitride micropipettes of 3 μm to 6 μm in diameter located at the bottom of a microwell [3, 4]. Upon filling with the respective ion-selective membranes, the array is aimed at monitoring extracellular K^+, NH_4^+ and Ca^{2+} in e.g. hepatocyte cell cultures. The development of a generic technology platform and the characterization of the ISEs in standard and physiological solutions as well as for detecting necrosis of fibroblast cell cultures will be presented.

References

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